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ORIGINAL STUDY

Cup oversizing as a risk factor for postoperative groin pain in Total Hip Arthroplasty : a retrospective analysis of 437 hips

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The majority of patients are pain free after total hip replacement, but some experience anterior hip pain due to iliopsoas impingement. There is evidence that a prominent or malpositioned cup may cause iliopsoas tendonitis. The purpose of this study was to determine whether oversizing the cup is a risk factor for postoperative groin pain.

We retrospectively investigated 437 total hip replacements in which the femoral head diameter had been measured for other research purposes. Data regarding the cup size and positioning was collected from implant identification labels and pelvis x-rays. Clinical data were recovered from the medical files. Native femoral head size, cup size, anteversion, inclination and DS (difference between native femoral head size and cup size) and type of pain (anterior hip pain or non-anterior hip pain) were analyzed and correlations were sought.

There was a strong and significant correlation between native femoral head size and cup size. Mean DS was 5.5 mm in the no pain group, 6.9 mm in the anterior hip pain group and 5.9 mm in the non-anterior hip pain group. The difference in mean DS was significant (P=0.046) in patients experiencing anterior hip pain vs. those with no pain or non-anterior hip pain.

As patients with anterior hip pain had a significant larger DS of 6.9 mm, it seems that a cup size of more than 6 mm above the native femoral head size should be avoided. We therefore recommend a systematic intraoperative head size measurement prior to definite cup choice.

Keywords : groin pain ; psoas impingement ; hip replacement arthroplasty

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INTRODUCTION

The main indications for Total Hip Arthroplasty (THA) are pain and poor health-related quality of life assessments. It has been convincingly shown that quality of life improves to above the level of an age- and gender-matched population one year postoperatively, with a considerable reduction of pain *(11)*. In some patients, however, there is a persistent perception of some degree of hip pain postoperatively despite well-fixed components. The reported incidence of persistent pain in the early years postoperatively after THA is 0% to 40% *(1)* and the degree of pain was quantified with visual analog scales. Complete clinical and

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radiographic data were collected on all patients so that the occurrence of pain could be correlated with a number of parameters previously reported to affect the incidence of pain, including age, sex, activity level, length of follow-up, stem size, bone type (Dorr index. The source of the pain can be considered as extrinsic or intrinsic to the hip joint. Extrinsic causes of hip pain are common and include spinal pathology, inguinal hernia, vascular disease and abductor tendinopathy. Intrinsic causes can be divided into being either extracapsular or intracapsular. The extracapsular causes of pain include iliopsoas tendonitis, heterotopic ossification or trochanteric bursitis. Intrinsic or implant related causes include aseptic loosening, infection, prosthetic failure, osteolysis, stem tip pain, pending stress fracture, instability, peri-prosthetic fracture, non-union, or impingement *(7)*. The site of pain may give some insight into its source. Anterior hip pain or groin pain may be related to iliopsoas tendinitis and impingement. The reported prevalence of groin pain after conventional primary THA varies between 0.4% and 18.3% *(5)*. Iliopsoas tendonitis and impingement may be related to a prominent or malpositioned acetabular component, retained cement, excessively long screws or the presence of an acetabular cage or reinforcement ring *(6)*. In refractory cases, a psoas tenotomy can be considered *(4)*. An arthroscopic release has also been described as a safe and effective treatment option *(13)*.

One purpose of this study was to assess the correlation between the native femoral head size (NFHS) and cup size (CS) in our series. The major objective was to figure out whether oversizing of the cup is a risk factor for postoperative groin pain.

METHODS

Patients

Prior to undertaking the investigation, ethical clearance was obtained from the Ethics Committee (ref. nr S57134 / ML11027). A monocentric retrospective study was conducted on 437 consecutive patients who received a primary THA between 2008 and 2011, whose femoral head size had been systematically measured intraoperatively for other research purposes. All patients had surgery in the same hospital by or under direct supervision of the senior author. With the patient in the lateral decubitus position, a standard posterior surgical approach was used. An anterior capsular release was routinely performed. Acetabular reaming was first done until the true floor was reached with subsequent progressive enlargement of the reamer size until a good grip in peripheral cancellous bone was obtained. All patients had a hybrid total hip arthroplasty with an uncemented cup and a polyethylene lipped liner (Trilogy, Zimmer, Warsaw, USA), a 32-mm metal head (V40, Stryker, Mahwah, USA) and a cemented polished double tapered stem (Exeter V40, Stryker, Mahwah, USA). To avoid bias by influencing the choice for a particular cup diameter, the native maximal femoral head diameter was only measured after reaming and inserting the acetabular component. A transosseus capsulotendinous repair was done routinely. Patients with a history of Developmental Dysplasia of the Hip, Legg-Calvé-Perthes or acetabulum/hip fracture were excluded from the study.

Data collection

Patients had a regular follow-up in the outpatient clinic by the senior author or an experienced resident and information was recorded in the medical files. Data collected during the last follow-up consultation were used for this study. Pain was classified into 3 groups: No Pain (NP), Anterior Hip Pain (AHP) or non-Anterior Hip Pain (non-AHP). AHP was defined as groin pain mentioned by the patient, clinically confirmed during active flexion of the hip with less pain or no pain during passive flexion. Non-AHP was defined as trochanteric pain or thigh pain. If the pain mentioned by the patient was most likely extrinsic to the hip joint (e.g. low back pain), this was classified as “no pain”. No difference was made according to frequency, intensity or time of onset after surgery. In addition to pain type, other demographical data (side, follow-up, age, complications and preoperative diagnosis) were recovered from the medical files.

Details concerning the implants were collected from the identification labels.

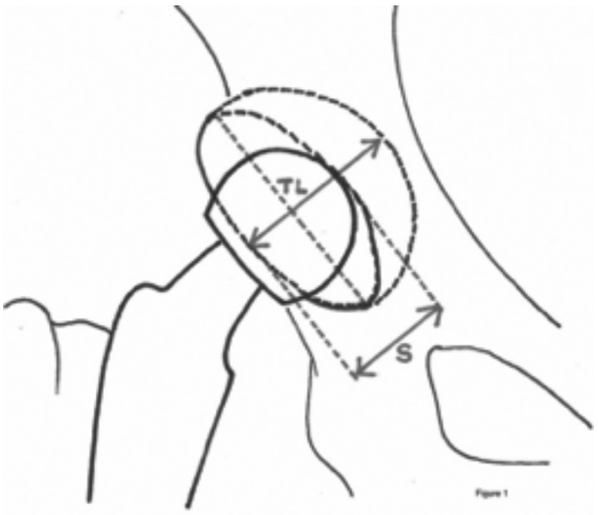

Figure 1. — Cup anteversion angle. Cup anteversion angle was measured according to the Widmer's method on pelvis AP x-rays. The anteversion was calculated from the following formula: arcsin (S/TL) with S : short axis of the ellipse and TL : the total length of the projected cross-section of the component (cup).

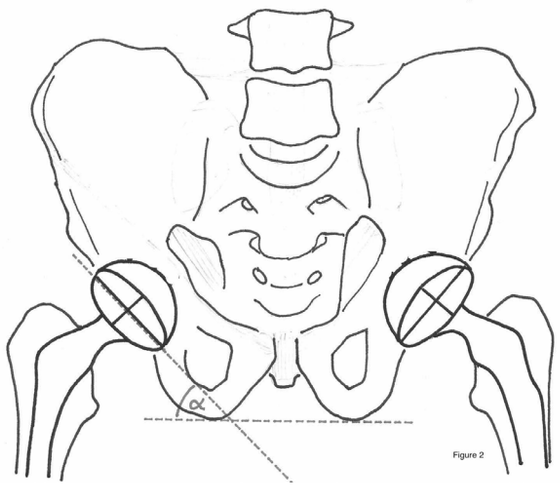

Figure 2. — Cup inclination angle. The inclination angle was measured between the axis of the cup and the intertuberous line.

Cup positioning parameters were measured on standard pelvis AP, hip AP and lateral X-rays done routinely for all patients. Cup anteversion angle was measured on pelvis AP views according to Widmer's method *(14)* (Figure 1). Ante- or retroversion was determined as described by Dorr and Wann *(3)* with the version on the pelvis AP radiograph compared to the version on the AP radiograph of the hip. If the ellipse was thinner on the pelvis AP, the cup was considered anteverted and vice-versa. The cup inclination angle was measured on the pelvis AP view between the cup axis and the intertuberous line (Figure 2). Several studies have demonstrated that these methods are reliable and reproducible compared to CT scan measurements *(8,9)*.

Study objectives

The first objective of this study was to determine the correlation between the native femoral head size and the implanted cup size. However, the major purpose was to assess whether there is a statistical correlation between the size of the cup relative to the size of the head and anterior hip pain.

Statistical analysis

Descriptive statistics of the numeric variables NFHS, CS, inclination and anteversion was done with a 95% confidence interval (CI). The difference between NFHS and CS was calculated and mentioned as DS. Correlation analysis between these variables was performed using the Spearman correlation test. For every previously mentioned numeric variable, a correlation analysis between different pain groups (NP, AHP and non-AHP) was done using the Independent Samples Kruskal Wallis test. The statistical analyses were done using IBM SPSS Statistics version 22.0 (Armonk, New-York, USA).

RESULTS

There were 169 male and 268 female patients. Their median age was 66 years (range 31 to 91 years). The average follow-up period was 26.6 months. Left/right ratio was 0.86. The preoperative diagnosis was osteoarthritis in 410 patients, avascular necrosis in nineteen patients and inflammatory arthritis in eight cases. At final follow-up, six patients had sustained a periprosthetic fracture. Three fractures could be treated conservatively and in three cases the stem had to be revised. One patient had sustained a

dislocation after a fall. No revision was done. On one occasion there had been an early prosthetic joint infection, treated with an early debridement and exchange of the mobile parts. Two patients had a sciatic nerve neuropathy. At final follow-up, none of these patients with a complication had pain. Forty-one patients had postoperative pain (10 AHP and 31 non-AHP). The remaining 396 patients had no pain. Mean NFHS was 49.8 mm (CI 49.4-50.2 ; range 40 to 60), mean CS was 55.4 mm (CI 55.0-55.7 ; range 48 to 68) and mean DS was 5.6 mm (CI 5.4-5.7 ; range 2 to 14). There was a strong and significant correlation between NFHS and CS ($r=0.872$ and $P<0.0001$). Mean NFHS was 49.9 mm (range 40 to 60) in the NP group, 49.7 mm (range 45 to 54) in the AHP group and 48.6 mm (range 42 to 58) in the non-AHP group. The difference was not significant ($P=0.139$). Mean CS was 55.4 mm (range 48 to 68) in the NP group, 56.6 mm (range 50 to 62) in the AHP group and 54.3 mm (range 50 to 62) in the non-AHP group. The difference here was also insignificant ($P=0.160$). Mean DS was 5.5 mm (range 2 to 14) in the NP group, 6.9 mm (range 4 to 10) in the AHP group and 5.9 mm (range 2 to 10) in the non-AHP group. The difference in mean DS was indeed significant ($P=0.046$). When DS is 6 mm, the odds ratio for AHP vs. NP was 2.85 (0.61-13.33), but this was not significant. Mean inclination was 34.3° (CI 33.8°-34.9° ; range 16.9° to 49.8°). Mean inclination was 34.4° (range 16.9° to 49.8°) in the NP group, 32.7° (range 22.1° to 44°) in the AHP group and 34.1° (range 22.5° to 43.8°) in the non-AHP group. The difference was not significant ($P=0.542$). Mean anteversion was 29.9° (CI 29.2°-30.5° ; range 8.2° tot 49.9°). In the NP group, mean anteversion was 29.8° (range 8.2° to 49.9°), in the AHP group 28.5° (range 22.4° to 34.4°) and in the non-AHP group 32.1° (range 18.6° to 45.0°). There was no significant difference ($P=0.126$).

CONCLUSIONS

In this study we investigated the correlation between the native femoral head size and cup size. The major objective was to figure out whether oversizing of the cup is a risk factor for postoperative groin pain.

There was a mean DS of 5.6 mm with a strong and significant correlation between NFHS and CS, indicating that the senior author had a consistent way of enlarging the acetabulum relative to the head size. The results of this study also indicate that there is an association between postoperative groin pain and DS, as mean DS is significantly higher in patients with AHP (6.9 mm) in comparison to patients with non-AHP (5.9 mm), and no pain (5.5 mm). These findings are consistent with those obtained by Odri et al *(10)*. They retrospectively analyzed 237 patients and also found that patients with AHP had a significantly higher DS. Furthermore they calculated odds ratios for a specific threshold and described that when DS³ 6 mm there was significantly more AHP. In our series this was not significant but we feel that this threshold is rather arbitrary.

Cup positioning (inclination and anteversion) has also been shown to be related to groin pain *(2,6,10,12)*. However, the findings of the current study do not support this previous research.

The prevalence of groin pain in our series was 2.3%. This is relatively low compared to other reports *(5,10)*. The senior author routinely performed an extensive anterior capsulotomy. Possibly this might protect the iliopsoas tendon to some extent against impingement. On the other hand, reaming up to the true floor and then extending more proximally, we possibly implanted our cups deeper so less overhang could have been encountered. Consequently we medialized our cups more for which we compensated by using more femoral offset, allowing global offset to be restored. Surprisingly, as compared to Odri et al *(10)*, we implanted larger cups (CS 55.4 vs 52mm) and our mean DS was clearly more pronounced (DS 5.6 vs 2 mm).

The key strength of this study is the large and homogeneous study population, as these 437 patients were operated by the same surgeon using a very systematical approach. There were no patients lost to follow-up. However, there are also limitations. This is a retrospective evaluation with end points based on patient reports and clinical examination, so a patient and / or surgeon bias may occur. However, patients, the treating surgeon and the clinicians doing the routine follow-up were

completely unaware of this study as this was only planned later.

Although drawing conclusions from these data is difficult, it seems that reaming more than 6 mm above the NFHS should be avoided, so we recommend a systematic intraoperative NFHS measurement. Furthermore, in cases such as revision THA's where a larger cup is often needed, a preventive psoas release could be considered.

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